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*Allanite in the Granite of the North of Scotland.* By WILLIAM MACKIE, M.A., M.D.

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ALLANITE has been recorded as occurring in a number of the granites of the North of Scotland, but while engaged on a research on these rocks for another purpose, I have discovered its presence in a number of rocks in which it has not previously been recorded. The granites in which it occurs may be enumerated. They are:—(1) Hildesay granite (Shetland); (2) Lairg, Sutherlandshire; (3) Ben Rinnes (grey); (4) Ben Laoghal, Tongue; (5) Ben Nevis; (6) Peterhead; (7) Loch Roag, Lewis; (8) Kennethmont, Aberdeenshire; (9) Marscow, Skye; and I have quite recently identified it in the granite of (10) Assouan, Egypt. It seems therefore to be fairly widely distributed in granitic rocks generally, and to all appearance indifferently in rocks of basic and acid type.

It has previously been recorded as occurring in the first three of the foregoing list, but I am not aware that it has hitherto been observed in any of the others.

In Hildesay granite, where it occurs in unterminated prisms in association with epidote, and in which I observed it as long ago as 1900, it often forms the cores of the epidote crystals which characterise that granite. Here it is frequently found to be twinned. Exact measurements are difficult if not impossible, owing to the high absorption of the mineral, but the following angles of extinction with the twinning line have been observed— $14^\circ$ ,  $59^\circ$ —mean  $36\frac{1}{2}^\circ$ ;  $55^\circ$ ,  $20^\circ$ —mean  $37\frac{1}{2}^\circ$ . With the edge of the prism in another case it was found to be  $36^\circ$ . It is often beautifully striated by fine parallel lines, which in one case were observed to meet in the centre of a section at an angle of  $123^\circ$ . In a foliated variety of this granite it is also found in the centre of the epidotes, and in two cases observed it gave extinction angles of  $40^\circ$  and  $36^\circ$  respectively with the edge of the prism.

In Lairg granite it occurs usually in perfect prisms, which are occasionally partly sheathed in epidote, but unterminated prisms also occur. Extinction angles of  $38^\circ$ ,  $32^\circ$ ,  $35^\circ$  have been noted. It occurs here in relatively large crystals and is often beautifully zoned and frequently shows irregular fissuring.

In Ben Rinnes grey granite, which is a more basic and younger granite than the ordinary red granite of that mountain, I have only observed one example—a relatively large crystal cut transversely. In the granite of Ben Laoghal it has been noted in one

or two slides in relatively small crystals, and these in the cases observed have been cut transversely. In Ben Nevis granite one small zoned crystal has been observed, and that was in the most acid variety of the Ben Nevis rock which contains no hornblende and very little biotite. In the red granite of Peterhead it has been observed twice—in one case in a beautifully striated, rather narrow prism associated with biotite. The other was a transverse and somewhat opaque section in which the characters of the mineral were observed with difficulty. Magnetite existed as an inclusion in the former. In a highly acid biotite granite showing strong cataclastic features from Loch Roag in Lewis, and of which a red and a grey variety occur, specimens of which were kindly sent me by Mr T. Fraser, C.E., Inverness, allanite frequently occurs in small prisms and always where observed in association with epidote. Extinction angles of  $40^\circ$  and  $36^\circ$  with the long axis of the prism have been noted. Here magnetite has been repeatedly observed as an inclusion. A single prism has been observed in a granite from Kennethmont, which is associated with the diorite of Aberdeenshire, and shows a large amount of biotite and a very little hornblende in addition to the ordinary constituents. This example gave an extinction angle of only  $24^\circ$  with the long axis of the prism, but that was probably cut more or less transversely. It showed beautiful zoning as well as a mottled green and brown centre. In a specimen of the granophyre of Skye from a gully on the N.W. of Marscow, sent me by Dr Horne, what is evidently allanite occurs associated with green augite, and a little hornblende, in a coarsely micropegmatitic rock which shows idiomorphic quartz crystals set in orthoclase. It is in somewhat irregular grains which show irregular fissuring, and has partly decomposed, staining the surrounding section a brown colour. A similar staining, it should have been stated, surrounded the crystal in Peterhead granite. Extinction angles, in the Skye specimen of  $38^\circ$ ,  $26^\circ$ ,  $36^\circ$ , were observed in different crystals. In the Assouan granite the allanite was included in orthoclase and gave an extinction angle of  $40^\circ$ .

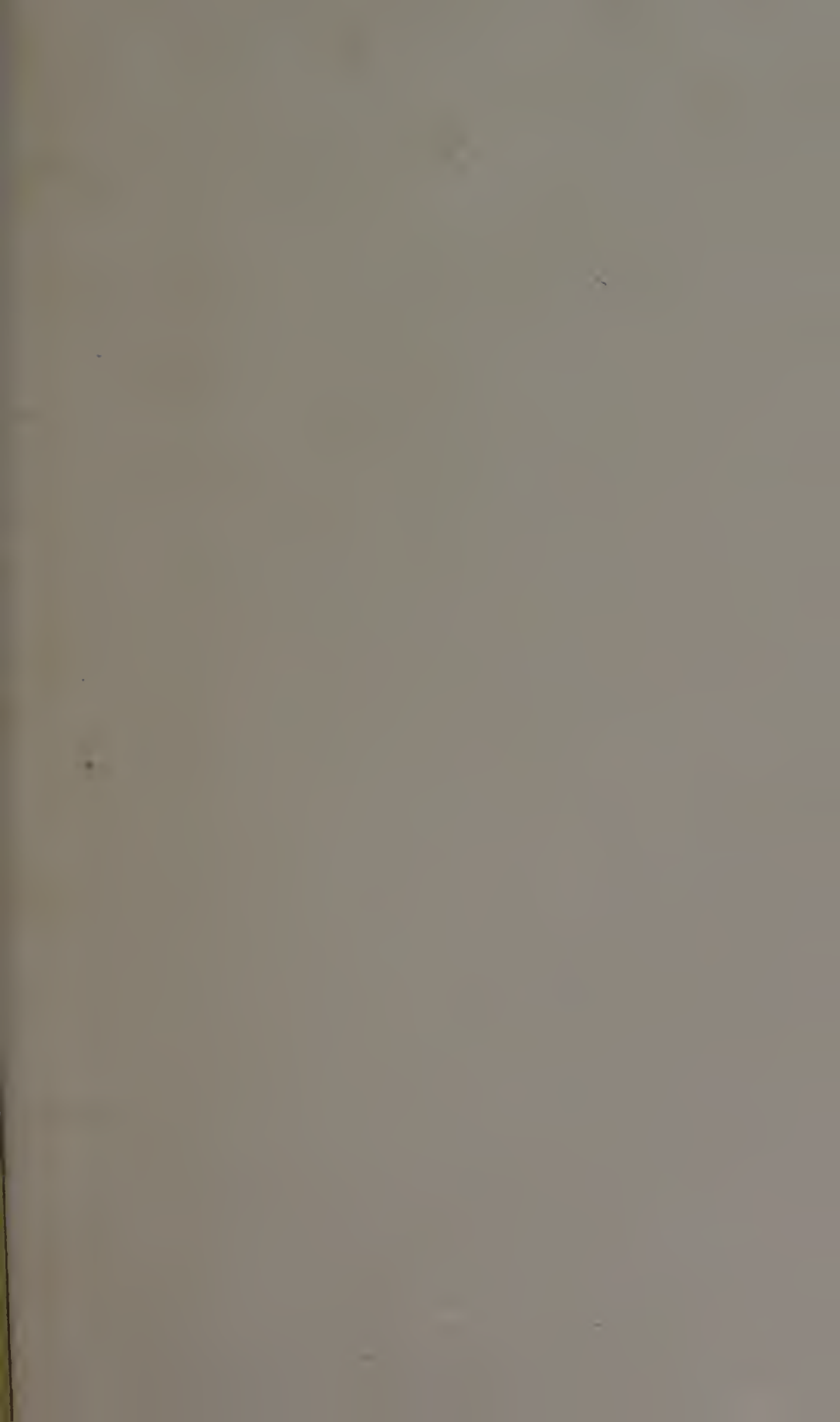
The peculiarities of allanite as regards distribution and occurrence appear to be—it is independent of the character of the rock as regards acidity or basicity; it is very frequently associated with epidote; often contains magnetite as an inclusion,—indeed that is up to the present the only inclusion observed; it always appears early—if not in fact the very first in the order of crystallization. This latter characteristic is the more remarkable, seeing that it is one of those hydrated minerals which as a class are unstable at high temperatures. Its occurrence must, therefore, indicate conditions of enormous pressure at

the time of its crystallization. The extinction angles average  $36^{\circ}$  with the long axis of the prism.

Other exceptional minerals in granitic rocks have been observed in one or two instances. Fluorspar in colourless crystals has been observed in one slide of Peterhead granite, where it apparently occurred as an original mineral. It has also been identified in one or two slides of Abriaehan granite, Inverness-shire, in colourless as well as deep violet patches, but here it is evidently of the nature of an infiltration product.

A peculiar radiated, colourless mineral has also been observed in Hildesay granite in one slide. Its refractive index is slightly lower than orthoclase. In addition to its radiated character it also shows a minute lamellar structure with concentric arrangement, and presents on the whole an appearance not unlike a spider's web. It gives a black cross in polarised light. It has not been identified, but may possibly be cordierite.









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